

means for coalescing adjacent elements of the same category to form compound elements.

27. (Amended) The apparatus according to claim 26 further including means for eliminating said diagonal elements by redesignating each diagonal element or part of each diagonal element as a horizontal element having a value equal to a nearest adjacent horizontal element.

28. (Amended) The apparatus according to claim 1 wherein said comparing means includes means for comparing a plurality of segments of said tune with a plurality of segments from said plurality of computer-readable music files, means for determining a number of matches of each segment-type, and wherein said output means the bases the likelihood of a match on a comparison of the profile of the number of each segment-type for said tune and for said music files.

29. (Amended) The apparatus according to claim 11 wherein the means for measuring a degree of matching includes means for determining a number of transformation functions required in order to match the representations a) and b).

30. (Amended) The apparatus according to claim 1 wherein said computer-readable music files and/or said input search criteria comprise audio files.

31. (Amended) The apparatus according to claim 30 wherein said comparing means further includes means to identify relevant selected portions of said audio files likely to contain tunes by detecting a component of the audio signal which is common to both left and right channels of a stereo pair of channels.

A marked up version of the above amendments showing the changes made is included.

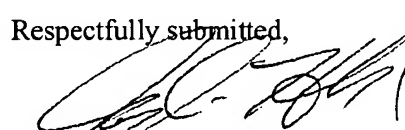
CONCLUSION

Applicant(s) submit(s) that no new matter is added as a result of this amendment.

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Respectfully submitted,

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MARKED UP AMENDMENTS AND CLAIMS

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PRIORITY

The present application is a continuation application of PCT/GB00/03035, filed August 7, 2000.

TECHNICAL FIELD OF THE INVENTION

The invention is related to the field of search engines and databases adapted to search for particular musical sequences or phrases in a database of sound files in a computer system.

BACKGROUND OF THE INVENTION

The present invention relates to search engines and databases, and in particular to search engines adapted to search for particular musical sequences or phrases in a database of recorded or encoded sound files in a computer system.

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SUMMARY

It is an object of the invention to provide a method and apparatus for providing musical search criteria as input to a search engine, in a manner which is easy to use by the unskilled or non-expert user.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a schematic diagram of apparatus for conducting a music search in a database, according to an embodiment of the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

With reference to figure 1 there is shown a computer system 1 suitable for implementing the music search method of the present invention. Preferably, the computer system comprises conventional hardware in the form of a processor 2, memory 3, monitor 4, keyboard 5 and microphone 6. Preferably, the computer system 1 also includes a MIDI compatible music keyboard 7 and appropriate modem links 8 to external data databases.

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ABSTRACT

The invention relates to an apparatus for searching a database of music files comprising input means to provide search criteria comprising a tune as a sequence of melodic intervals, comparing means for comparing the sequence of melodic intervals with selected portions of a plurality of computer-readable music files and output means to provide a list of possible matches of the search criteria with at least one of the plurality of computer-readable music files.

CLAIMS

1. (Amended) An apparatus for [effecting a] searching [through] a database of music files, comprising:

input means[, for] to provide[ing as input] search criteria comprising a tune as a sequence of melodic intervals;

comparing means, for comparing said sequence of melodic intervals with selected portions of a plurality of computer-readable music file; and

output means, to [for] provide[ing as output] a list of possible matches of said search criteria with at least one[s] of said plurality of computer-readable music files.

2. (Amended) The apparatus according to claim 1 wherein said input means comprises a microphone into which a user can sing, hum or whistle said tune.

3. (Amended) The apparatus according to claim 1 wherein said input means comprises a MIDI keyboard for playing the tune.

4. (Amended) The apparatus according to claim 1, claim 2 or claim 3, wherein the input means further includes a pitch recognition means [for] to identify[ing] each melodic interval between a succession of musical pitches input as said tune.
5. (Amended) The apparatus according to [any one of] claim[s] 1 [to 4] wherein said input means further includes quantization means [for] to determin[e][ing] a closest chromatic interval, a closest whole tone interval, or a closest minor or major third interval between two successive musical pitches.
6. (Amended) The apparatus according to [any one of] claim[s] 1 [to 4] wherein said input means further includes quantization means [for] to determin[e][ing] a closest major, minor or other scale to which successive musical pitches will fit.
7. (Amended) The apparatus according to [any preceding] claim 1 further including means to [for] a) determin[e][ing], from said input sequence of melodic intervals, a succession of rhythmic intervals and b) use[ing] said succession of rhythmic intervals as further search criteria.
8. (Amended) The apparatus according to [any preceding] claim 1 further including means to [for] provide[ing] as input [further] additional search criteria comprising text information.
9. (Amended) The apparatus according to [any preceding] claim 1 wherein said comparing means includes means for comparing one or more segments of said tune with said selected portions of said plurality of computer-readable music files, and wherein said output means bases the likelihood of a match [based] on the number of separate segments and/or selected portions for which a possible match is indicated.
10. (Amended) The apparatus according to claim 9 wherein said segments of the search tune and/or said selected portions of the music file are defined as overlapping note sequences.
11. (Amended) The apparatus according to [any preceding] claim 1 wherein said comparing means includes:

means for representing a) the input sequence of melodic intervals, and b) the selected portions of said plurality of computer-readable music files, each as a function of pitch against time, and

means for measuring a closeness of fit of said representations a) and b) to determine a degree of matching of the input sequence [and] to each one of the selected portions.

12. (Amended) The apparatus according to claim 11 further including transformation means for applying at least one transformation function to at least one of the functions a) and b) prior to measuring a closeness of fit.

13. (Amended) The apparatus according to claim 12 wherein said at least one transformation function comprises any one of: a translation in pitch; a translation in time; a scaling in time; a variable scaling in time over different parts of the graph; a variable pitch translation over different parts of the graph; and a transformation by removal of selected sections from the graph.

14. (Amended) The apparatus according to claim 11 wherein said means for measuring closeness of fit comprises means for determining an error score for an *i*-note input sequence compared against an *n*-note selected portion of said music file for each of a plurality of values of *n*.

15. (Amended) The apparatus according to claim 14 further including means for determining a value of *n* for which the error score is minimized.

16. (Amended) The apparatus according to claim 15 further including means for varying *n* about a start value until an error score minimum is attained.

17. (Amended) The apparatus according to [any preceding] claim 1 wherein said comparing means includes to identify relevant selected portions of a plurality of computer-readable music files by applying selection criteria to identify portions of the files likely to contain tunes.

18. (Amended) The apparatus according to claim 17 wherein said relevant selected portions of said music files are stored in an index.

19. (Amended) The apparatus according to claim 18 wherein said relevant selected portions stored in said index are encoded as text, said input means further including means for encoding said sequence of melodic intervals as text string, and said comparing means comprising a text search engine.

20. (Amended) The apparatus according to claim 17 wherein the location, in said computer-readable music files, of said relevant selected portions of said music files are indicated by one or more tags, and said comparing means are adapted to locate said tags.

21. (Amended) An apparatus for indexing a music database comprising:

means for identifying relevant selected portions of a plurality of computer-readable music files by applying criteria to identify portions of the files likely to contain tunes; and

means for tagging said music files to identify positions corresponding to said relevant selected portions.

22. (Amended) An apparatus for indexing a music database comprising:

means for identifying relevant selected portions of a plurality of computer-readable music files by applying selection criteria to identify portions of the files likely to contain tunes; and

means for generating an index of said music files containing information representative of said relevant selected portions.

23. (Amended) A method for effecting a search through a database of music files, comprising:

providing as input, search criteria comprising a tune as a sequence of melodic intervals;

comparing said sequence of melodic intervals with selected portions of a plurality of computer-readable music files; and

providing as output, a list of possible matches of said search criteria with at least one[s] of said plurality of computer-readable music files.

24. (Amended) A computer program product, comprising a computer readable medium having thereon computer program code means adapted, such that when said program is loaded onto a computer, [to make the] said computer executes said method [the procedure] of claim 23.

25. (Amended) An apparatus for determining a sequence of melodic intervals from an input source comprising:

input means for providing an input signal waveform representing a tune;

note discretization means comprising means for dividing a frequency-time representation of said input signal waveform into discrete time periods to form a succession of input tune elements and, for each input tune element, determining a single gradient of the input over said time period.

26. (Amended) The apparatus according to claim 25 further including:

means for designating the gradient of each element as one of the categories selected from the group consisting of: horizontal / near horizontal; diagonal; and vertical / non-vertical; and

means for coalescing adjacent elements of the same category to form compound elements.

27. (Amended) The apparatus according to claim 26 further including means for eliminating said diagonal elements by redesignating each diagonal element or part of each diagonal element as a horizontal element having a value equal to a nearest adjacent horizontal element.

28. (Amended) The apparatus according to claim 1 wherein said comparing means includes means for comparing a plurality of segments of said tune with a plurality of segments from said plurality of computer-readable music files, means for determining a number of matches of each segment-type, and wherein said output means the bases the likelihood of a match [based] on a comparison of the profile of the number of each segment-type for said tune and for said music files.

29. (Amended) The apparatus according to claim 11 [in which] wherein the means for measuring a degree of matching includes means for determining a number of transformation functions required in order to match the representations a) and b).

30. (Amended) The apparatus according to claim 1 wherein said computer-readable music files and/or said input search criteria comprise audio files.

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